Remarks

The November 24, 2009 Office Action rejected:

(a) claims 1-6 and 8-17 as anticipated based on U.S. patent 5,714,166 ("Tomalia et al.) as evidenced by two newly cited articles (Mijovic et al. and Encyclopedia Britannica Online);

(b) claims 1, 3-6, 11-14 and 16 were held obvious based on U.S. patent application publication 2002/0102434 ("Inoue et al.) alone; and

(c) claims 2, 8-10, 24, 26-28 and 35-39 were held obvious based on Inoue et al. in view of a Baldo et al. article.

In view of the amendment above and remarks below, reconsideration is respectfully requested.

Nature Of Amendment

In claim 1, and thus all claims dependent thereon, the dendrimers have been described as having at least one inherently at least partially conjugated dendron. This is based on the disclosure at page 6, lines 21-22 of the published PCT specification. Dependent claims 11 to 14 relate to narrower embodiments having specific numbers and arrangements of inherently at least partially conjugated dendrons and are properly retained as dependent upon amended claim 1.

§ 102 Rejections

Claims 1-6 and 8-17 were held anticipated based on U.S. patent 5,714,166 ("Tomalia et al.) as purportedly evidenced by two newly cited articles (Mijovic et al. and Encyclopedia Britannica Online). As an initial matter it should be noted that the two articles bear publication dates of 2004 and 2007. Thus, they do not antedate Applicants' 2003 PCT priority date and can't be used as prior art. Of course, in an anticipation context they should not be used as secondary art anyway.

Use of a non-prior art article to evidence what is inherent in a prior art reference would be permitted. However, the teaching of Mijovic et al. and the Encyclopedia Britannica Online online extract are not considered as relevant to the teaching of Tomalia et al. for the following

reasons.

The Office Action argues that Mijovic et al. substantiates the position that the PAMAM dendrimers of Tomalia et al. are conductive, and that the Encyclopedia Britannica Online online extract shows that the conductivity disclosed of Mijovic is within the range of semi-conductor values. This type of argument relies upon both Mijovic et al. and the Encyclopedia Britannica Online online extract being accurately representative of the characteristics of the Tomalia et al. dendrimers. If, however, Mijovic et al. and/or the Encyclopedia Britannica Online online extract are not appropriate evidentiary documents in the context of Tomalia et al., then the anticipation rejection must fail.

It is respectfully submitted that Mijovic et al. and the Encyclopedia Britannia extract are not probative evidentiary documents. In particular, the Office Action refers to Figure 11 of Mijovic et al., which discloses conductivity results for PAMAM dendrimers. The Office Action then proceeds to suggest that this is combinable with the graph in the Encyclopedia Britannica Online online extract, and that the range of values in Figure 11 of Mijovic et al. are indeed representative of conductive materials (with the implication being that the Mijovic et al. materials, and potentially the Tomalia et al. materials, are semiconductors).

However, what the Office Action fails to note is that the PAMAM dendrimers in Tomalia et al. are in liquid form, and that they therefore demonstrate ionic conductivity. The Encyclopedia Britannica Online extract relates to an entirely different form of conductivity, namely semiconductive conductivity of solid materials. As an example, the Encyclopedia Britannica Online extract shows semiconductive properties of conventional semiconductor materials (e.g. gallium arsenide etc.), contrasting these with insulating and conductive properties of other solid materials.

A key point to note is that the Encyclopedia Britannica Online extract relates to conductive properties (especially semi-conductive properties) in solid materials. It has no relevance to ionic conductivity in a liquid, such as the

liquid PAMAM dendrimers of Mijovic et al. As the Examiner will appreciate, ionic conductivity is markedly different from semiconductivity. In ionic conductivity the current is carried mainly by mobile ions, whereas in semiconductors it is carried by electrons.

Furthermore, in ionic conductivity there is an electrochemical reaction at the contact/electrode, as for example in a Li:ion battery. There is thus a major difference between ions carrying charge in a solution, and electrons carrying in a solid semiconductor. For example, the phase of the substance is different (liquid electrolyte versus solid semi-conductor), and the nature of the charge carrier is different (ion versus electron).

In view of the above, Mijovic et al. and Encyclopedia Britannica Online are not appropriately combined with Tomalia et al. They fail to provide the necessary evidence for the Examiner's anticipation rejection. We therefore maintain our argument that the dendrimers of Tomalia et al. are not conductive, as discussed in our previous response.

In addition to the argument above, it should also be noted that claim 1 has been amended to require that the dendrimers have at least one inherently at least partially conjugated dendron. As discussed in the specification at page 6, lines 22 to 25, the preferred dendrons have conjugation between branching groups and linking groups (if present), but because of the arrangement of the branching points the pi-system is not necessarily fully delocalized.

For this reason the dendrons are described as inherently at least partially conjugated. This requirement for at least partial conjugation is clearly novel over Tomalia et al. As discussed in our previous response, the compounds exemplified in Tomalia et al. are polyamidoamine (PAMAM) dendrimers made up of alkyl amides. In these compounds, saturated alkylene groups are linked together in dendritic structures by bidentate amide groups and tridentate nitrogen atoms (see the PAMAM dendrimers exemplified in columns 60 to 62 of Tomalia et al.). The dendrimers exemplified in Tomalia et al. therefore contain saturated alkyl linker groups without any double

bonds, and are not conjugated as required by current claim 1. Accordingly, the claimed compositions are not anticipated by Tomalia et al.

As additional observations with regard to the anticipation rejection, we have noted the comments in paragraph 9 of the Office Action, in to our previous arguments. With regard to the conductivity point (see the third and fourth paragraphs of paragraph 9 of the Office Action) this has been comprehensively discussed above: the dendrimers of Tomalia et al. are not charge transporting and/or emissive in the context of current claim 1.

Nevertheless it is also worth mentioning that the Office Action briefly states that the associated material in Tomalia et al. is "chemically bonded" to the dendrimer. The implication is that, when chemically bonded to a charge transporting and/or emissive associated material, the "dendrimer" as a whole will be charge transporting and/or emissive. However, this brief comment does not give an accurate picture of the full disclosure of Tomalia et al. In particular, column 17, lines 41 to 48 of Tomalia et al. mentions that the carried material may be "associated with" the dendrimer in a large number of ways, for example it may be physically encapsulated or entrapped within the core of the dendrimer, dispersed partially or fully throughout the dendrimer, or attached or linked to the dendrimer or any combination thereof, whereby the attachment or linkage is by means of covalent bonding, hydrogen bonding, absorption, absorption, metallic bonding, van der Waals forces or ionic bonding, or any combination thereof.

It should be noted that covalent bonding is merely mentioned in passing, as only one of a host of different forms of association. It is certainly not an absolute requirement of Tomalia et al. that the dendrimer and the associated material are chemically (e.g. covalently) bonded to one another. With regard to the exemplified blends disclosed in Tomalia et al. (e.g. blend P and Q in example 42), these relate to conjugates of genetic material and dendrimers. In such conjugates the genetic material and dendrimer are

associated by means of ionic bonding, van der Waals forces, hydrogen bonding, metallic bonding or any combination thereof.

This section says, very specifically, that the carried material is not associated with the dendrimer to covalent bonding. To suggest that Tomalia et al. teaches that the associated material can be chemically bonded and that, by extension, the "dendrimer" may be charge transporting (conductive) and/or emissive by virtue of its chemical bond to the associated material is therefore slightly misleading. In a very large number of example complexes in Tomalia et al. the associated material will not be covalently bonded to the dendrimer, and it would not be accurate to describe a mixture of dendrimers as being charge transporting and/or light omitting.

It is very clearly the associated material, and not a mixture of dendrimers, that is charge transporting and/or emissive. In the specific examples of blends P and Q relied upon by the Office Action in formulating the anticipation rejection, the conjugates of genetic material and dendrimer will not be covalently bonded (as clearly stated at column 47, lines 61 to 62). Accordingly, it is not true to say that a mixture of the dendrimers in blends P & Q would be charge transporting and/or emissive. For this reason we respectfully submit that there is no clear evidence that the blends of dendrimers disclosed in Tomalia et al. would be charge transporting and/or emissive.

For the reasons discussed above, the subject matter of claim 1, and all remaining claims which depend from or refer back to claim 1, is not anticipated by Tomalia et al. Reconsideration of the rejection of claims 1-6 and 8-17 as being anticipated by Tomalia et al. with further evidence provided by Mijovic et al. and Encyclopedia Britannica Online online is therefore respectfully requested.

§ 103 Rejections

Claims 1, 3-6, 11-14 and 16 were held obvious based on U.S. patent application publication 2002/0102434 ("Inoue et al.) alone.

With regard to Inoue et al. alone, the Office Action maintains that it would have been obvious to one of ordinary skill in the art to use a combination of a plurality of compounds of formula (I) of Inoue et al. In response to this we respectfully submit that the skilled person would not contemplate preparing such a combination of dendrimers.

There is no clear direction in Inoue et al. to make any such combination, nor is there any suggestion that such a combination would be desirable. The person skilled in the art certainly would not consider that preparation of such a combination would be associated with any particular technical effect or advantage. Furthermore, the claimed combinations actually represent a very narrow subset of the alleged, theoretically possible combinations which the Office Action suggests would have been made by the skilled person based on the disclosure of Inoue et al. These arguments are explained in more detail below.

The skilled person would not be drawn to combine two different dendrimers having the same core and the same repeating unit but having a different generation based on the teaching of Inoue et al. In this regard, the Office Action suggests in the last paragraph on page 7 that the skilled person would expect similar phosphorescent properties for dendrimers having structural similarities. Applying this logic, the skilled person would expect a combination of similar dendrimers (for example those having the same core and the same repeating unit but a different generation) to have similar properties to the individual dendrimers in isolation.

In effect, there would be nothing to be gained by preparing a combination of dendrimers compared to using single dendrimers in isolation. On this basis there is no motivation to prepare a combination as required by claim 1: the skilled person would think this unnecessary - why go to the extra time and effort of making two distinct dendrimers and combining these in a further composition if the resulting properties are likely to be the same as the individual dendrimers in isolation? The need to prepare two different dendrimers and to combine these into a single composition would seem like an

unnecessary and inefficient additional step. There is certainly no teaching in Inoue et al. to suggest that such a combination would be advantageous, nor is there anything to even suggest this as a possibility. Indeed, Inoue et al. seems to relate to the use of single dendrimers in isolation, and not two combinations.

In view of this, it is clear that the present inventors' findings, that mixtures of dendrimers with the same core and the same repeating unit but having different generations, is advantageous and is surprising. The skilled person would have considered a combination to be no more effective than individual dendrimers: he certainly would not have expected the improved efficiency results evidenced in Professor Paul Burn's declaration filed with our most recent response. For this reason, the claimed compositions are not obvious having regard to Inoue et al.

Furthermore, the claimed compositions actually represent a very narrow selection out of the alleged, theoretically possible combinations that could have been made from Inoue et al. This is because the claimed compositions require the same core and the same repeating units. In Inoue et al., the range of possible cores is vast. For example, in claim 1 L_0 can be any one of o-, p- and m- phenylene groups having two, three or four rings and which may have a substituent. Each of these possibilities represent a different possible core group.

The number of variables in the nature of group L_o alone is enormous. Thus, even if motivated to combine two different dendrimers (which we maintain the skilled person would not be minded to do), the range of possible combinations or cores for the two dendrimers is absolutely enormous; restricting to a single type of core actually limits to a very small group of possible combinations the Office Action alleges would have been made from Inoue.

Furthermore, the range of possible repeating units in Inoue et al. is similarly vast. As noted from claim 1, the branching groups R_{01}, R_{02}, R_{03} and R_{04} have many variables, leading to myriad possible variations of the repeating unit. To choose one specific repeating unit for both dendrimers is

actually very restrictive; it represents a tiny fraction of the possible combinations which the Examiner alleges would have been made from Inoue et al.

It can therefore be seen that selection of the claimed compositions actually represents a very narrow selection from the theoretically possible combinations encompassed by Inoue. This demonstrates two things:

1. The claims represent a very narrow selection out of Inoue et al., with there being no motivation to focus in on such a small number of possible mixtures theoretically encompassed by that document. The subject matter of claim 1 is therefore non-obvious.
2. The data filed in Professor Burn's declaration is actually appropriate and commensurate to the scope of claims. Although the Examiner argues that this is not the case, the discussion above demonstrates that the scope of the claims is actually very narrow compared to the potential scope of Inoue et al. Accordingly, the quantity of data provided thus far is appropriate under the circumstances.

For these reasons, the subject matter of claim 1 should be held non-obvious over the disclosure of Inoue et al.

Claims 2, 8-10, 24, 26-28 and 35-39 were rejected as being obvious in view of Inoue et al., and further in view of Baldo et al.

With regard to the combination of Inoue et al. and Baldo et al., Baldo et al. does not make up for the deficiency of Inoue et al. discussed above. Baldo et al. certainly does not teach use of combinations of dendrimers, and in particular does not teach the very specific combination of dendrimers having the same core and the same repeating unit but different generation.

With regard to the later claims, the Office Action has dismissed our previous argument that the compounds of Inoue et al. would have different properties to those in Baldo et al. The Office Action maintains that the properties would actually be similar due to similarities in structure. In particular, the Office Action suggests that the cited references Zhao et

al. and Xin et al. are not relevant because they relate to pyrene in isolation, and not to a TPD-type compound modified with pyrene.

The Office Action goes on to cite US 2005/0079385 suggesting that this demonstrates that pyrene derivatives have suitable properties to be used in combination with $Ir(ppy)_3$. From a proper review of US 2005/0079385, however, it can be seen that this relates to entirely different compounds to those disclosed in Inoue et al. In particular US 2005/0079385 has pyrene as a core group, whereas, in complete contrast, compounds such as compounds 22 and 23 of Inoue et al. have pyrene as a terminal group, at the very edge of the dendrimer.

The electronic properties, and in particular the suitability of the compounds to be used in conjunction with $Ir(ppy)_3$, simply cannot be extrapolated from US 2005/0079385 to Inoue et al. because the pyrene in that document is significantly shielded by the surrounding phenyl groups. In fact, electronic behaviour of pyrene in isolation (as referred to in our previous response) may actually be more representative of the electronic behaviour of the pyrene groups in Inoue et al. than the behaviour of the pyrene groups in US 2005/0079385. Accordingly, we maintain our position that the Inoue et al. materials would quench the luminescence of the $Ir(ppy)_3$ complex due to the presence of the terminal pyrene groups.

In view of the arguments above, one of ordinary skill in the art would not consider combining the teaching of Inoue et al. and Baldo et al. when seeking to provide new and improved dendrimer compositions for light emitting devices. Even if the teachings of these documents were to be combined, it is not obvious how this should be achieved because the teachings are at least in part incompatible. Furthermore, the combinations of two documents would certainly not lead to the blends required by claim 1. Accordingly, we submit that the subject matter of claims currently on file is non-obvious over these documents. Having demonstrated that the subject matter of claim 1 is non-obvious over the cited documents, it is respectfully submitted that the remaining claims, all of which

depend from or refer back to claim 1, are also non-obvious.

Conclusion

As such, reconsideration and allowance are respectfully requested of the remaining amended claims. Enclosed is a three month extension petition. Apart from that, no additional fees are believed necessary for the entry of this amendment. However, if any are, please charge Deposit Account 17-0055 for the amount of the fee.

Respectfully submitted,

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